HATCHERY EVALUATION REPORT

Cowlitz Salmon Hatchery - Fall Chinook

March 1997

Integrated Hatchery Operations Team (IHOT)

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Cowlitz Salmon Hatchery - Fall Chinook

An Independent Audit Based on Integrated Hatchery Operations Team (IHOT) Performance Measures

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Project Number 95-2
Contract Number 95AC49468

March 1997

CONTENTS

List of Tables

Table

6 Annual Operating Expenses - Cowlitz Salmon Hatchery

Section 1

Executive Summary

This report presents the findings of the independent audit of the Cowlitz Salmon Hatchery - Fall Chinook program. The hatchery is located on the Cowlitz River (river mile 45) approximately 10 miles from Mossyrock, Washington. The hatchery is used for adult collection, incubation, and rearing of spring chinook, fall chinook, and coho (Type N). Steelhead and cutthroat are also collected at this facility.

The audit was conducted in 1996-1997 as part of a 2-year effort that will include 67 hatcheries and satellite facilities located on the Columbia and Snake River system in Idaho, Oregon, and Washington. The hatchery operating agencies include the U.S Fish and Wildlife Service, Idaho Department of Fish and Game, Oregon Department of Fish and Wildlife, and Washington Department of Fish and Wildlife.

Background

The audit is being conducted as a requirement of the Northwest Power Planning Council (NPPC) ÒStrategy for SalmonÓ and the Columbia River Basin Fish and Wildlife Program. Under the audit, the hatcheries are evaluated against policies and related performance measures developed by the Integrated Hatchery Operations Team (IHOT). IHOT is a multi-agency group established by the NPPC to direct the development of new basinwide standards for managing and operating fish hatcheries. The Bonneville Power Administration (BPA) contracted with Montgomery Watson to act as an independent contractor for the audit.

IHOT has established five basic policies that cover: (1) hatchery coordination, (2) hatchery performance standards, (3) fish health, (4) ecological interaction, and (5) genetics. The audit focuses on all these policies, with the exception of hatchery coordination. These policies are set forth in *Policies and Procedures for Columbia Basin Anadromous Salmonid Hatcheries (IHOT 1995).* That document is the source for the performance measures that are the basis of this audit.

The Audit Process

The audit was based on the facility managementÕs response to a 109-page questionnaire. This audit form was completed through a five-step process in which:

- Information was obtained from headquarters.

- The hatchery manager was asked to fill out and return the audit form.

- A 1-2 day site audit visit was conducted to inspect facilities, review hatchery records, discuss audit form responses, and develop remedial action plans.

- A compliance report was developed to document the compliance status of each performance measure. This report was then shared with the hatchery manager and IHOT representative.

- This hatchery evaluation report was written to document compliance with IHOT performance measures and develop cost estimates for remedial actions when needed.

Cowlitz Salmon Hatchery - Fall Chinook Results

The Cowlitz Salmon facility includes ponds for adult holding, 36 concrete raceways, and incubation facilities. The hatchery was built in 1967 and is owned and funded by Tacoma City Light as mitigation for the fish impact caused by Mossyrock and Mayfield dams. The goal of the hatchery is 17,300 spring chinook adults, 8,300 fall chinook adults, and 25,500 coho adults return to Cowlitz River barrier dam.

The Cowlitz Salmon Hatchery - Fall Chinook program was in general compliance with most of the performance measures. In the area of program objectives, the hatchery was not meeting its adult return goal and needed to increase its production. The audit found that the hatchery was not in compliance with the incubation and rearing temperature criteria, screen approach criteria, water quality monitoring requirements, predator control requirements, and pathology-free water criteria, which are all facilities requirements. The hatchery was not meeting the flow criteria for incubation and the density and flow criteria for rearing The hatchery was not meeting all the transportation, alarm, or food storage criteria. The hatchery did not have a Genetics Monitoring and Evaluation Program or a smoltification goal and monitoring plan.

The specific areas in which the Cowlitz Salmon Hatchery - Fall Chinook program requires remedial actions based on the IHOT performance measures are listed below. These remedial actions are listed in alphabetical order without intent of ranking or otherwise assigning priority:

- Change flow criteria for vertical stack incubators or increase flow
- Change pond cleaning procedures to improve production
- Check water flow alarms daily
- Chill 780 gpm by 5 °F for incubation
- Conduct IHOT QA/QC tests for feed preparation
- Construct 4 additional BurrowÕs pond
- Construct bird netting over 125,000 sf of raceway area
- Construct new screening facility to meet IHOT criteria
- Develop approved genetics M&E plan

- Develop disease-free water supply for incubation and early rearing (1,300 gpm)
- Develop smoltification goal and monitor
- Develop training schedule
- Document eyed-egg to fry survival
- Document number of eggs, fry, fingerlings, smolts, and/or adults to meet basinwide needs
- Follow IHOT protocols for disinfection of fish tank interior
- Follow IHOT protocols for disinfection transport vehicle cab
- Follow IHOT protocols for wearing protective garments when handling fish eggs or cultural water
- Follow IHOT temperature criteria for hauling
- Increase flow by 700 gpm/unit for modified BurrowÕs ponds
- Install alarms on adult holding, headboxes, and rearing ponds
- Install security alarms
- Install telephone pagers
- Monitor DO in the transport tank
- Monitor and record TGP
- Reroute discharge line to downstream of dam (72Ó line)
- Run analysis for water chemistry parameters, turbidity, alkalinity, hardness, nitrite, and contaminants
- Verify that a daily service inspection of the fish transport vehicle is completed before starting up and leaving for the day
- Verify that fish transport truck/chassis and tank/unit receive an inspection and service prior to the release season

Non-compliance issues resulting from items beyond human control or Performance Measures not relevant to this hatchery (Type 1 in Table 3, Section 4 of this report) were not listed above.

Section 2

Facility Description

Name:	Cowlitz Salmon Hatchery
Stock/Species:	Fall Chinook
	Coho (Type N)
	Spring Chinook
	Steelhead
Operating Agency:	Washington Department of Fish and Wildlife
Funding Agency:	Tacoma City Light
Location:	The hatchery is located on the Cowlitz River (river mile 45) approximately 10 miles from Mossyrock, Washington.
Address:	2284 Spencer Road
	Salkum, WA 98582
Hatchery Manager:	Mr. Don Peterson
Phone:	(360) 985-7424
Fax:	(360) 985-7500
Purpose:	The hatchery was built in 1967 and is owned and funded by Tacoma City Light as mitigation for the fish impact caused by Mossyrock and Mayfield dams. The goal of the hatchery is 17,300 spring chinook adults, 8,300 fall chinook adults, and 25,500 coho adults return to Cowlitz River barrier dam.
Production Goal:	**Fall Chinook**
	Produce 6,500,000 subyearlings for on-station releases
	Provide 10,500 eggs/fish to co-op programs

Provide eggs/fish to other facilities

Coho (Type N)

Produce 4,700,000 yearling for on-station release

Produce 800,000 to 1,200,000 subyearlings for upstream coho fishery

Provide 61,200 eggs/fish to co-op programs

Provide eggs/fish to other facilities

Spring Chinook

Produce 1,720,000 yearlings and subyearlings for on-station releases

Provide 60,000 egg/fish to co-op programs

Provide fingerlings for Upper Cowlitz Anadromous Fish Restoration

Provide eggs/fish to other facilities

Steelhead

Imprint 80,000 to 160,000 steelhead smolts - April release

Water Supply:

Water rights total 89,776 gpm from the Cowlitz River and 1,000 gpm from wells. The wells are used between September and April, normally for egg incubation and early fry rearing

Facilities:

Adult Holding:	Ladder + two adult holding ponds
Incubation:	270 16-tray vertical stack incubators (4,320 trays)
Early Rearing:	None

Raceways:	31 Modified BurrowÕs ponds - 15,000 cf each
	5 Modified BurrowÕs ponds - 11,000 cf each
	18 Kettles (raceways) - 2,250 cf each
Rearing Ponds:	None
Satellite Facilities:	None

Section 3

Compliance Status

The hatchery audits are based on compliance with written IHOT performance measures. These performance measures are documented in ***Policies and Procedures for Columbia Basin Anadromous Salmonid Hatcheries*** (referred to as *IHOT 1995* in this report).

The purpose of the performance measures is to implement new basinwide policies that provide regional guidelines for operating anadromous hatcheries in the Columbia Basin.

The audit focuses on performance measures for IHOT policies that cover (1) hatchery performance standards, (2) fish health, (3) ecological interaction, and (4) genetics. These performance measures are intended to guide hatchery operations once production is established. For that reason, the hatchery operations audit included broodstock collection, spawning, incubation of eggs, fish rearing and feeding, fish release, equipment maintenance and operations, and personnel training. Production priorities are beyond the scope of this audit.

Based on *IHOT 1995*, a detailed 109-page audit form was developed. The audit form divided the performance measures into six major sections along major program and technical criteria areas. Two additional sections (sections 1 and 8) include general information and expenditure information needed for this Hatchery Evaluation Report and blank forms for additional comments. The following is the basic structure of the IHOT audit form:

Section 1	Performance Measures for General Information and Expenditure Information (PMs General 1-2)
Section 2	Performance Measures for Program Objectives (PMs 1-4)

Integrated Hatchery Operations Team (IHOT) 1995. *Policies and Procedures for Columbia Basin Anadromous Salmonid Hatcheries*, Bonneville Power Administration, Portland, Oregon.

Section 3	Performance Measures for Facility Requirements (PMs 5-15)
Section 4	Performance Measures for Hatchery Practices (PMs 16-25)
Section 5	Performance Measures for Fish Health Policy (PMs 26-34)
Section 6	Performance Measures for Ecological Interactions (PMs 35-38)
Section 7	Performance Measures for Genetics Policy (PMs 39-43)
Section 8	Blank Forms for Additional Comments.

Several performance measures are repeated in various sections of the audit form. These performance measures overlap in *IHOT 1995* and were retained to allow individuals interested in specific portions of the audit (such as Genetics or Fish Health) to determine the compliance status of all performance measures for a given topic in one location. A repeated performance measure is indicated by shaded text.

The Hatchery Audit Process

The hatchery audit will be conducted over a 2-year period that concludes in 1997. At each hatchery, a five-step process was used to complete the overall hatchery audit. This process consisted of research and onsite visits. The site visit at the Cowlitz Salmon Hatchery was conducted on March 17, 1997.

The following is the five-step audit process:

1. Information was obtained from headquarters.

2. The hatchery manager was asked to fill out and return the **Audit Form**.

3. A 1-2 day site audit visit was conducted at each hatchery. During that visit an audit team inspected facilities, reviewed hatchery records, discussed audit form responses, and developed remedial action plans when appropriate.

4. During the site visit, the compliance status of each performance measure was discussed with the hatchery manager and IHOT representative. A portion of the Hatchery Evaluation Report was sent to the hatchery manager following the audit visit as a **Compliance Report**. That Compliance Report is Table 2 of this report.

5. Information from steps 1-4 was used to prepare a draft **Hatchery Evaluation Report**. This draft report was submitted to the operating agencies for review of the information used to determine compliance. Based on review and comments, a final Hatchery Evaluation Report was developed. The final report documents the compliance of a particular hatchery with the IHOT performance measures and presents cost estimates to correct any deficiencies.

Compliance Status of Cowlitz Salmon Hatchery - Fall Chinook

The following table includes information on life-stages that are held on this facility for some portion of their rearing cycle (Table 1). For multi-facility programs, summary cost and contribution data is presented at the facility where rearing occurs. For the compliance status relating to performance measures that do not occur at this hatchery, please refer to the Hatchery Evaluation Reports for the hatcheries and stocks listed in Table 1. A check mark (4) indicates that the specific life-stage is held at this facility.

This section documents the compliance status of the Cowlitz Salmon Hatchery - Fall Chinook program. Each performance measure is presented in a table taken from the audit form (Table 2). The compliance status is identified by the following categories:

- **N/A** (not applicable)
- **Yes** (in compliance)
- **?** (unknown; generally due to unavailability of information to determine compliance)
- **No** (not in compliance).

Remedial actions are suggested for performance measures not in compliance. These remedial actions are grouped into categories and listed in Section 4 of this report, where the cost of the required remedial actions is also presented.

Table 1 Summary Program Information for Cowlitz Salmon Hatchery - Fall Chinook

Component	Location of Adult Holding, Spawning, Incubation, and Rearing					
	Cowlitz Salmon Hatchery					
Adult Collection	4					
Adult Holding	4					
Spawning	4					
Fertilization	4					
Incubation						
green-to-eyed	4					
eyed-to-hatch	4					
Rearing						
fry	4					
fingerlings	4					
smolts	4					
Acclimation/release	4					

Table 2 Cowlitz Salmon Hatchery - Fall Chinook Compliance With Performance Measures

PM #	Description of Performance Measure	Compliance Status				Basis for Compliance or Non-Compliance	Remedial Action Needed for Compliance
		N/A	Yes	?	No		
#1	**Are the hatchery programs outlined in a subbasin management plan?**		4			Columbia Basin System Planning Production Plan and FERC #902 Tacoma City Light	
#2	**Is the hatchery operating under a current hatchery operational plan?**		4			IHOT Operations Plan and Hatchery Operations Plan	
	Is it understood by staff?		4				
	Is it being followed?		4				
#3	**Is a hatchery monitoring and evaluation plan in place?**						
	Do you have a written monitoring and evaluation plan?		4				
#4a	**Adult contribution to fisheries, spawning grounds, and hatchery**		4			Review of Records	
#4b	**Adult pre-spawning survival as compared with established goal**		4			Review of records; in compliance 3 out of last 3 years	
#4c	**Egg-take as compared with established hatchery goal**		4			Review of records; in compliance 3 out of last 3 years	

Table 2 Cowlitz Salmon Hatchery - Fall Chinook Compliance With Performance Measures

		N/A	Yes	?	No		
#4d	**Green-egg to eyed-egg survival as compared with established goal**		4			Review of records; in compliance 3 out of last 3 years	
#4e	**Eyed-egg to fry survival as compared with established goal**			4		No data provided	Document eyed-egg to fry survival
#4f	**Fry to smolt survival as compared with established goal**		4			Review of records; in compliance 4 out of last 4 years	
#4g	**Production as compared with established goal**				4	Review of records; in compliance 1 out of last 3 years	Change cleaning procedures to reduce inventory shortages
#4h	**Percent survival (smolt to adult) as compared with established goal**				4	Review of records; Goal - 2.5%, in compliance 0 out of last 4 years	Increase adult returns
#4i	**Number of eggs, fry, fingerlings, smolts, and/or adults to meet basinwide needs**	4					

Table 2 Cowlitz Salmon Hatchery - Fall Chinook Compliance With Performance Measures

PM #	Description of Performance Measure	Compliance Status				Basis for Compliance or Non-Compliance	Remedial Action Needed for Compliance
		N/A	Yes	?	No		
#5a	**Temperature**						
	Does your water temperature meet the criteria for spawning?		4			Review of records/Discussion	
	Does your water temperature meet the criteria for incubation?				4	Review of records/Discussion	Chill 780 gpm by 5 °F
	Does your water temperature meet the criteria for rearing?				4	Need to heat 20,000 gpm by 8 °F	None
#5b	**Dissolved gases**						
	Is the oxygen level near saturation?		4			Review of records/Discussion	
	Is the dissolved nitrogen level less than saturation?			4		Review of records/Discussion	Monitor TGP and record
#5c	**Chemistry**						
	Ammonia (un-ionized)			4		No data	Run analysis
	Carbon Dioxide			4		See above	See above
	Chlorine			4		See above	See above
	pH			4		See above	See above
	Copper			4		See above	See above
	Hydrogen Sulfide			4		See above	See above
	Iron			4		See above	See above
	Zinc			4		See above	See above

Table 2 Cowlitz Salmon Hatchery - Fall Chinook Compliance With Performance Measures

		N/A	Yes	?	No		
#5d	**Turbidity**						
	Does your turbidity meet the criteria?			4		No data	Run analysis

Table 2 Cowlitz Salmon Hatchery - Fall Chinook Compliance With Performance Measures

PM #	Description of Performance Measure	Compliance Status				Basis for Compliance or Non-Compliance	Remedial Action Needed for Compliance
		N/A	Yes	?	No		
#5e	**Alkalinity and hardness**						
	Does your alkalinity and hardness meet the criteria?			4		No data	Run analysis
#5f	**Nitrite**						
	Does your nitrite meet the criteria?			4		Review of records/Discussion	
#5g	**Contaminants**						
	Aldrin			4		No data	Run analysis
	Endrin			4		See above	See above
	Dieldrin			4		See above	See above
	Heptachlor			4		See above	See above
	Chlordane			4		See above	See above
	Methoxychlor			4		See above	See above
	Lindane			4		See above	See above
	Malathion			4		See above	See above
	Guthion			4		See above	See above
#5h	**Pathogens**						
	What portions of the hatchery have disease-free water?						
	Adult holding				4	All water from river and shallow wells	None
	Incubation				4	See above	Develop disease-free water supply for incubation and early rearing (1,300 gpm)

Table 2 Cowlitz Salmon Hatchery - Fall Chinook Compliance With Performance Measures

		N/A	Yes	?	No		
	Early rearing				4	See above	See above
	Rearing				4	See above	None
	Others				4	See above	None

Table 2 Cowlitz Salmon Hatchery - Fall Chinook Compliance With Performance Measures

PM #	Description of Performance Measure	Compliance Status				Basis for Compliance or Non-Compliance	Remedial Action Needed for Compliance
		N/A	Yes	?	No		
#6	**Alarm Systems**						
	Do the following areas have alarms?						
	Intake		4			Inspection of facilities/Discussion	
	Large rearing ponds and adult holding ponds				4	Inspection of facilities/Discussion	Install alarms on adult holding ponds
	Raceway headboxes and rearing ponds				4	Inspection of facilities/Discussion	Install alarms on headboxes and rearing ponds
	Incubation facilities		4			Inspection of facilities/Discussion	
	Quarantine areas and facilities	4				No quarantine areas and facilities	
	Water treatment systems	4				No water treatment systems	
	Security				4	Inspection of facilities/Discussion	Install security alarms
	Are there outside systems and buzzers in onsite residences?		4			Discussion	
	Are water flow alarms checked daily?				4	Review of records/Discussion	Check water flow alarms daily
	Are all other alarms checked weekly?		4			Discussion	
	Is there a log of alarms for emergencies, tests, and maintenance requirements?		4			Review of records/Discussion	
	Are telephone pagers used?				4	Discussion	Install telephone pagers

Table 2 Cowlitz Salmon Hatchery - Fall Chinook Compliance With Performance Measures

		N/A	Yes	?	No		
#7	**Adult collection and holding facilities**						
	Do you meet the adult holding criteria?		4			Review of records/Discussion	

Table 2 Cowlitz Salmon Hatchery - Fall Chinook Compliance With Performance Measures

PM #	Description of Performance Measure	Compliance Status				Basis for Compliance or Non-Compliance	Remedial Action Needed for Compliance
		N/A	Yes	?	No		
#8	**Incubation facilities**						
	Type 1: Vertical stack Do you have an adequate number of units for the overall program?		4			Inspection of facilities/Discussion	
	Type 2: _____ Do you have an adequate number of units for the overall program?	4					
#9	**Rearing facilities**						
	Type 1: Modified BurrowÕs Ponds Do you have an adequate number of units for the overall program?				4	Inspection of facilities/Discussion	Remedial action listed under PM #19
	Type 2: Kettles (raceways) Do you have an adequate number of units for the overall program?		4			Inspection of facilities/Discussion	
	Type 3: _____ Do you have an adequate number of units for the overall program?	4					

Table 2 Cowlitz Salmon Hatchery - Fall Chinook Compliance With Performance Measures

		N/A	Yes	?	No		
#10	**Screening facilities**						
	Do you meet the approach velocity criteria?				4	Inspection of facilities/Discussion	Construct new screening facility to meet IHOT criteria
	Are the fish screens regularly cleaned?		4			Inspection of facilities/Discussion	
	Does the screen mesh meet screen opening criteria?				4	Inspection of facilities/Discussion	Construct new screening facility to meet IHOT criteria
	Are rearing containers double screened for fish that should not be released to adjacent water?	4					
#11	**Predator control facilities**						
	Are your predation control facilities effective?				4	Inspection of facilities/Discussion	Construct bird netting over 125,000 sf of rearing area

Table 2 Cowlitz Salmon Hatchery - Fall Chinook Compliance With Performance Measures

PM #	Description of Performance Measure	Compliance Status				Basis for Compliance or Non-Compliance	Remedial Action Needed for Compliance
		N/A	Yes	?	No		
#12	**Food storage facilities and quality control**						
	Does the storage of dry/semi-moist/moist foods (dry<12%; semi-moist 12-20%; moist >20% moisture) follow food manufacturerÕs recommendations?		4			Inspection of facilities/Discussion	
	Does a regional quality control officer oversee production procedures and monitor:						
	Verification by feed manufacturer that ingredients meet specifications?				4	Discussion	Conduct IHOT QA/QC tests for feed preparation
	Ensure feed does not contain unwanted drugs or other additives?				4	Discussion	See above
	Analyze ingredients contained in the final food product to ensure that feed specifications have been met?				4	Discussion	See above
	Are the foods stored and handled according to the following criteria?						

Table 2 Cowlitz Salmon Hatchery - Fall Chinook Compliance With Performance Measures

		N/A	Yes	?	No		
	Moist pellets should not exceed 10 °F at point of delivery.		4			Discussion	
	Moist pellets should be removed from freezer just prior to feeding.		4			Discussion	
	Do not leave buckets of feed or feed containers outside exposed to light or heat.		4			Discussion	
	Open bags of feed should be fed within 1 to 2 days except when feeding small groups of fish.		4			Discussion	
	Automatic feeder hoppers and bulk storage facilities should be insulated against excessive temperatures (80°F and above).	4				None	

Table 2 Cowlitz Salmon Hatchery - Fall Chinook Compliance With Performance Measures

PM #	Description of Performance Measure	Compliance Status				Basis for Compliance or Non-Compliance	Remedial Action Needed for Compliance
		N/A	Yes	?	No		
#13	**Release facilities**						
	Do the release facilities ensure that fish are not subjected to adverse conditions?				4	Inspection of facilities/Discussion	Reroute discharge line to downstream of dam (72Ó line)
#14	**Pollution abatement facilities**						
	Do the pollution abatement facilities meet all federal and state regulations (or good engineering practice)?		4			Inspection of facilities/Discussion	
	Are pollution abatement facilities operated correctly?		4			Discussion	
#15	**Transportation facilities**						
	Are the transport systems adequate to meet IHOT performance measures for transportation practices?		4			Inspection of facilities/Discussion	

Table 2 Cowlitz Salmon Hatchery - Fall Chinook Compliance With Performance Measures

PM #	Description of Performance Measure	Compliance Status				Basis for Compliance or Non-Compliance	Remedial Action Needed for Compliance
		N/A	Yes	?	No		
#16	**Broodstock selection practices**						
	Is the donor selection process document attached? (PM #40a)	4				Existing program; does not apply	
	Was the donor selection outline followed in selecting the hatchery broodstock? (PM #40b-c)	4				Existing program; does not apply	
#17	**Spawning practices**						
	Were the appropriate number of spawners, male/female ratios, and fertilization protocols used? (PM #42c-g)		4			Review of records/Discussion	
#18	**Incubation practices**						
	Are specific incubation standards listed in the hatchery operations plan?		4			Reviewed IHOT Operations Plan and Hatchery Operations Plan	
	Are incubation practices written?		4			See above	
	Incubation Type 1: Vertical stack (see PM #8) Do you meet the loading and flow criteria?				4	Do not meet flow criteria	Change flow criteria for vertical stack incubator or increase flow

Table 2 Cowlitz Salmon Hatchery - Fall Chinook Compliance With Performance Measures

		N/A	Yes	?	No		
	Incubation Type 2: _____ (see PM #8) Do you meet the loading and flow criteria?	4				Review of records/Discussion	

Table 2 Cowlitz Salmon Hatchery - Fall Chinook Compliance With Performance Measures

PM #	Description of Performance Measure	Compliance Status				Basis for Compliance or Non-Compliance	Remedial Action Needed for Compliance
		N/A	Yes	?	No		
#19	**Rearing practices**						
	Are specific rearing standards listed in the hatchery operations plan?		4			Review IHOT Hatchery Operations Plan	
	Are rearing practices written?		4			Review Hatchery Operations Plan	
	Rearing Unit Type 1: Modified BurrowÕs Pond (see PM #9)						
	Do you meet the density and DI criteria?				4	Review of records/Discussion	Construct 4 additional BurrowÕs pond
	Do you meet the Loading and FI criteria?				4	Review of records/Discussion	Increase flow by 700 gpm/unit
	Rearing Unit Type 2: Kettles (see PM #9)						
	Do you meet the density and DI criteria?		4			Review of records/Discussion	
	Do you meet the Loading and FI criteria?		4			Review of records/Discussion	
	Rearing Unit Type 3: _____ (see PM #9)						
	Do you meet the density and DI criteria?	4					
	Do you meet the Loading and FI criteria?	4					
#20	**Smolt quality**						
	Do you produce a high quality smolt?		4			Discussion	

Table 2 Cowlitz Salmon Hatchery - Fall Chinook Compliance With Performance Measures

PM #	Description of Performance Measure	Compliance Status				Basis for Compliance or Non-Compliance	Remedial Action Needed for Compliance
		N/A	Yes	?	No		
#21	**Fish health management practices**						
	Are the monthly hatchery monitoring visits being conducted? (PM #26)		4			Review of records/Discussion	
	Are the annual broodstock inspections being conducted? (PM #27)		4			Review of records/Discussion	
	Is there pathogen-free water (PM #5h)and are the sanitation procedures being followed? (PM #28)				4	Review of records/Discussion	See PM #5h
	Are the following water quality parameters within criteria? (PM #5a-5g)						
	Water temperature				4	Review of records/Discussion	See PM #5a
	Dissolved gases			4		Review of records/Discussion	See PM #5b
	Chemistry			4		Review of records/Discussion	See PM #5c
	Turbidity			4		Review of records/Discussion	See PM #5d
	Alkalinity and hardness			4		Review of records/Discussion	See PM #5e
	Nitrite			4		Review of records/Discussion	See PM #5f
	Contaminants			4		Review of records/Discussion	See PM #5g
	Are rearing standards being followed? (PM #19)				4	Review of records/Discussion	See PM #19

Table 2 Cowlitz Salmon Hatchery - Fall Chinook Compliance With Performance Measures

		N/A	Yes	?	No		
	Are egg and fish transfer/release requirements met? (PM #31)		4			Review of records/Discussion	

Table 2 Cowlitz Salmon Hatchery - Fall Chinook Compliance With Performance Measures

PM #	Description of Performance Measure	Compliance Status				Basis for Compliance or Non-Compliance	Remedial Action Needed for Compliance
		N/A	Yes	?	No		
#22a	**Does hatchery performance meet requirements outlined in the regional hatchery policies and in subbasin and hatchery plans for the following areas?**						
#22a1	**Percent smoltification**						
	Do you measure percent smoltification?				4	Discussion	Develop smoltification goal and monitor
	Do you have a smoltification goal				4	Discussion	See above
	Did you meet the smoltification criteria?			4		Discussion	See above
#22a2	**Rearing density (prior to release)**						
	Did you meet the rearing density criteria just prior to release?		4			Review of records/Discussion	
#22a3	**Disease condition (at release)**						
	Did you meet all disease regulations just prior to release?		4			Review of records/Discussion	
#22a4	**Number (at release)**						
	Did you meet the release number goal?				4	Review of records/Discussion	See PM #43
#22a5	**Size at release**						
	Did you meet the size goal?		4			Review of records/Discussion	

Table 2 Cowlitz Salmon Hatchery - Fall Chinook Compliance With Performance Measures

		N/A	Yes	?	No		
#22a6	**Dates of release**						
	Did you meet the release date goal?		4			Review of records/Discussion	
#22a7	**Location of release**						
	Did you release the fish at the specified location?		4			Review of records/Discussion	
#22b	**Are fish reared in the subbasin or acclimated in the subbasin?**						
	Are the fish reared in the subbasin?		4			Discussion	
	Are the fish acclimated in the subbasin?		4			Discussion	
#22c	**Is the release strategy appropriate for the program?**		4			Discussion	

Table 2 Cowlitz Salmon Hatchery - Fall Chinook Compliance With Performance Measures

PM #	Description of Performance Measure	Compliance Status				Basis for Compliance or Non-Compliance	Remedial Action Needed for Compliance
		N/A	Yes	?	No		
#23	**Transportation facilities**						
	Do transportation equipment and personnel receive disinfection before and after use?		4			Discussion	
	Is the fish tank interior disinfected using a solution of 200 ppm active chlorine for 30 minutes minimum or formaldehyde gas generation method (relative humidity of 60% for 2 hrs)?				4	Discussion	Follow IHOT protocols for disinfection of fish tank interior
	Is the exterior of the fish transport vehicle disinfected using high pressure steam (115-130°C), high temperature acid, or with 200 ppm chlorine for 30 minutes?		4			Discussion	
	Is the fish transport vehicle (cab) disinfected using 600 ppm quaternary ammonia compounds (1.5 ml of 50% stock solution/liter water)?				4	Discussion	Follow IHOT protocols for disinfection of transport vehicle cab
	Is other equipment disinfected including fish pumps, nets, egg sorters, waders, boots, rain gear, hoses and other equipment using one of the following solutions?						

Table 2 Cowlitz Salmon Hatchery - Fall Chinook Compliance With Performance Measures

		N/A	Yes	?	No		
	200 ppm chlorine for 30 minutes 600 ppm quaternary ammonia compound for 30 minutes 200 ppm iodophor solution for 10 minutes		4			Discussion	
	Do personnel wear protective garments when handling fish eggs or cultural water?				4	Discussion	Follow IHOT protocols for wearing protective garments when handling fish eggs or cultural water
	Do the fish transport truck/chassis and tank/unit receive an inspection and service prior to the release season?			4		Transportation provided by Tacoma City Light personnel	Verify that fish transport truck/chassis and tank/unit receive an inspection and service prior to the release season
	Is a daily service inspection completed before starting up and leaving for the day?			4		See above	Verify that a daily service inspection is completed before starting up and leaving for the day

Table 2 Cowlitz Salmon Hatchery - Fall Chinook Compliance With Performance Measures

PM #	Description of Performance Measure	Compliance Status				Basis for Compliance or Non-Compliance	Remedial Action Needed for Compliance
		N/A	Yes	?	No		
#23 (cont)	**Transportation facilities**						
	Does the fish transport unit receive an inspection prior to loading?		4			Discussion	
	Does a pre-loading inspection covering tank water level, pumps or aerators, oxygen injection system settings, displacement gauge, and truck loading/hauling density tables checked and reviewed occur prior to loading fish in the transport unit?		4			Discussion	
	Do hauling criteria include checking the fish 45 minutes to 1 hour after loading?		4			Discussion	
	When fish are active and systems are functioning properly, is the oxygen concentration reduced and maintained at approximately 8 ppm?				4	Discussion	Monitor DO in transport tank
	Is water temperature in the transportation unit maintained within the 42-48 °F range?				4	Discussion	Follow IHOT temperature criteria for hauling

Table 2 Cowlitz Salmon Hatchery - Fall Chinook Compliance With Performance Measures

		N/A	Yes	?	No		
	Do fish releasing procedures include the following criteria?						
	Releasing the fish at the correct release site or into the correct water body.		4			Discussion	
	Tempering or the difference between the liberation tank and the target water body should not exceed 10°F.		4			Discussion	
	The liberation hose should be angled so that fish gently hit the water. Using a tripod is a method of ensuring the hose will stay at the proper angle.		4			Discussion	

Table 2 Cowlitz Salmon Hatchery - Fall Chinook Compliance With Performance Measures

PM #	Description of Performance Measure	Compliance Status				Basis for Compliance or Non-Compliance	Remedial Action Needed for Compliance
		N/A	Yes	?	No		
#24	**Evaluation practices**						
	Has the hatchery conducted fishery contribution studies to:						
	Determine the requirements for evaluating and improving management programs?		4			Discussion	
	Develop guidelines that define the geographical area and identify component stocks (hatchery and/or wild) that comprise the management unit?		4			Discussion	
	Develop guidelines that define if the proper stocks of fish are currently being used?		4			Discussion	
	Determine which management units contribute to a specific fishery and the time periods of those contributions?		4			Discussion	
	Determine the relative contributions of the various management units to a specific fishery over the different time periods?		4			Discussion	

Table 2 Cowlitz Salmon Hatchery - Fall Chinook Compliance With Performance Measures

PM #	Description of Performance Measure	Compliance Status				Basis for Compliance or Non-Compliance	Remedial Action Needed for Compliance
		N/A	Yes	?	No		
#25	**Training practices**						
	Does the hatchery have a training schedule for its staff?				4	Review of records/Discussion	Develop training schedule
	Does each staff member have a personal training plan approved by a supervisor and reviewed annually?		4			Review of records/Discussion	
	Does the hatchery routinely exchange training details between other hatcheries and agencies?		4			Review of records/Discussion	
	Does the hatchery encourage and reward off-duty training of staff?		4			Review of records/Discussion	
	Does the hatchery conduct monthly staff meetings?		4			Review of records/Discussion	

Table 2 Cowlitz Salmon Hatchery - Fall Chinook Compliance With Performance Measures

PM #	Description of Performance Measure	Compliance Status				Basis for Compliance or Non-Compliance	Remedial Action Needed for Compliance
		N/A	Yes	?	No		
#26	**Are monthly hatchery monitoring visits being conducted by a qualified fish health specialist as described below?**						
	Conduct visit at least monthly		4			Review of records/Discussion	
	Monitoring conducted by qualified fish health specialist		4			Review of records/Discussion	
	Examine a representative sample of healthy and moribund fish from each lot.		4			Review of records/Discussion	
	Review fish culture practices with hatchery manager.		4			Review of records/Discussion	
	Report finding and results of necropsies on standard form.		4			Review of records/Discussion	
	Recommend appropriate drug or chemical treatment.		4			Review of records/Discussion	
	Summarize fish health status or stock prior to release or transfer to another facility.		4			Review of records/Discussion	
#27	**Are all of the functions of the hatchery yearly monitoring visits being completed as described below?**						

Table 2 Cowlitz Salmon Hatchery - Fall Chinook Compliance With Performance Measures

		N/A	Yes	?	No		
	Annually examine each broodstock for the presence of reportable viral pathogens.		4			Review of records/Discussion	
	Annually screen each salmon broodstock for the presence of *Renibacterium salmoninarum*.		4			Review of records/Discussion	
	Conduct inspection by or under the supervision of qualified fish health specialist.		4			Review of records/Discussion	

Table 2 Cowlitz Salmon Hatchery - Fall Chinook Compliance With Performance Measures

PM #	Description of Performance Measure	Compliance Status				Basis for Compliance or Non-Compliance	Remedial Action Needed for Compliance
		N/A	Yes	?	No		
#28	**Is the hatchery following accepted sanitation procedures?**						
	Are there any sources of pathogen-free water, especially for incubation and early rearing?				4	Discussion	See PM #5h
	Are the hatchery sanitation procedures understood and being followed as described below?						
	Disinfect/water harden eggs in iodophor?		4			Inspection of facilities/Discussion	
	Are foot baths containing disinfectant placed at the incubation facilityÕs entrance and exit?		4			Inspection of facilities/Discussion	
	Is equipment and rain gear utilized in broodstock handling or spawning sanitized prior to its use elsewhere in the hatchery?		4			Inspection of facilities/Discussion	
	Is equipment used to collect dead fish sanitized prior its use in another pond and/or lot of fish?		4			Inspection of facilities/Discussion	

Table 2 Cowlitz Salmon Hatchery - Fall Chinook Compliance With Performance Measures

		N/A	Yes	?	No		
	Is equipment, including vehicles used to transfer fish between facilities, disinfected prior to use with any other fish lots or at any other location?		4			Inspection of facilities/Discussion	
	Are rearing vessels sanitized after fish are removed and prior to introducing a new fish lot or stock?		4			Inspection of facilities/Discussion	
	Are dead fish properly disposed of?		4			Inspection of facilities/Discussion	

Table 2 Cowlitz Salmon Hatchery - Fall Chinook Compliance With Performance Measures

PM #	Description of Performance Measure	Compliance Status				Basis for Compliance or Non-Compliance	Remedial Action Needed for Compliance
		N/A	Yes	?	No		
#29	**Are water quality parameters being followed?**						
	Are the following water quality parameters within criteria? (PM #5a-5g)						
	Water temperature				4	Review of records/Discussion	See PM #5a
	Dissolved gases			4		Review of records/Discussion	See PM #5b
	Chemistry			4		Review of records/Discussion	See PM #5c
	Turbidity			4		Review of records/Discussion	See PM #5d
	Alkalinity and hardness			4		Review of records/Discussion	See PM #5e
	Nitrite			4		Review of records/Discussion	See PM #5f
	Contaminants			4		Review of records/Discussion	See PM #5g
	Go to PM #21						
#30	**Are incubation and rearing standards being followed?**						
	Are the incubation practices following the IHOT incubation criteria? (PM #18)				4	Review of records/Discussion	See PM #18
	Are the rearing practices following the IHOT criteria? (PM #19)				4	Review of records/Discussion	See PM #19
	Go to rearing practices PM #18-PM #19						
#31	**Are egg and fish transfer/release requirements met?**		4			Discussion	

Table 2 Cowlitz Salmon Hatchery - Fall Chinook Compliance With Performance Measures

Table 2 Cowlitz Salmon Hatchery - Fall Chinook Compliance With Performance Measures

PM #	Description of Performance Measure	Compliance Status				Basis for Compliance or Non-Compliance	Remedial Action Needed for Compliance
		N/A	Yes	?	No		
#32	**Is the hatchery's program outlined in a subbasin management plan?** Go to subbasin plan PM #1		4			Columbia Basin System Planning Production Plan FERC #902 Tacoma City Light	
#33	**Is the hatchery operating under a current hatchery operational plan?** Go to operational plan PM #2		4			Review IHOT Operations Plan and Hatchery Operations Plan	
#34	**Is a hatchery monitoring and evaluation plan in place?** Go to hatchery monitoring and evaluation plan PM #3		4				

Table 2 Cowlitz Salmon Hatchery - Fall Chinook Compliance With Performance Measures

PM #	Description of Performance Measure	Compliance Status				Basis for Compliance or Non-Compliance	Remedial Action Needed for Compliance
		N/A	Yes	?	No		
#35	**Does the hatchery program meet requirements established in the regional hatchery policies and subbasin planning documents in the following areas: species, stock, broodstock collection location, broodstock numbers, broodstock collection strategy, and spawning and egg-take protocols?**						
	Does the hatchery program meet the requirements for the following?						
	Species protocols (PM #1)		4			Review of records/Discussion	
	Stock protocols (PM #1)		4			Review of records/Discussion	
	Broodstock collection location protocols (PM #41b for existing program; PM #39b for new program)		4			Review of records/Discussion	
	Broodstock numbers protocols (PM #42c)		4			Review of records/Discussion	
	Broodstock collection strategy protocols (PM #41b-d for existing program; PM 39b-f for new program)		4			Review of records/Discussion	

Table 2 Cowlitz Salmon Hatchery - Fall Chinook Compliance With Performance Measures

		N/A	Yes	?	No		
	Spawning protocols (PM #42d-e)		4			Review of records/Discussion	
	Egg-take protocols (PM #42f-g)		4			Review of records/Discussion	

Table 2 Cowlitz Salmon Hatchery - Fall Chinook Compliance With Performance Measures

PM #	Description of Performance Measure	Compliance Status				Basis for Compliance or Non-Compliance	Remedial Action Needed for Compliance
		N/A	Yes	?	No		
#36	**Does the hatchery's performance meet requirements outlined in the regional hatchery policies and in subbasin and hatchery plans for the following areas: percent smoltification, rearing density, disease condition, and the number, size date(s), and location of release?**						
	Percent smoltification (PM #22a1)				4	Review of records/Discussion	See PM #22a1
	Rearing density (PM #22a2)		4			Review of records/Discussion	
	Disease condition (PM #22a3)		4			Review of records/Discussion	
	Number at release (PM #22a4)				4	Review of records/Discussion	See PM #22a4
	Size at release (PM #22a5)		4			Review of records/Discussion	
	Date of release (PM #22a6)		4			Review of records/Discussion	
	Location of release (PM #22a7)		4			Review of records/Discussion	

Table 2 Cowlitz Salmon Hatchery - Fall Chinook Compliance With Performance Measures

		N/A	Yes	?	No		
#37	**Are fish reared in the subbasin or acclimated in the subbasin?** See PM #22b		4			Discussion	
#38	**Is the release strategy appropriate for the program?** See PM #22c		4			Discussion	

Table 2 Cowlitz Salmon Hatchery - Fall Chinook Compliance With Performance Measures

PM #	Description of Performance Measure	Compliance Status				Basis for Compliance or Non-Compliance	Remedial Action Needed for Compliance
		N/A	Yes	?	No		
#39	**For new programs, has a broodstock collection plan been developed?**						
#39a	Is the broodstock collection plan written?	4				Existing Program; does not apply	
	For a non-captive broodstock program:	4				Existing Program; does not apply	
#39b	Was an unbiased, representative sample collected?						
#39c	Was the recommended number of broodstock collected?	4				Existing Program; does not apply	
	For a captive broodstock program:						
#39d	Were captive brood progeny excluded as donors for propagating the next generation of the captive broodstock program?	4				Existing Program; does not apply	
#39e	Were full-sib crosses avoided?	4				Existing Program; does not apply	
#39f	Is the broodstock collection plan understood and being followed by staff?	4				Existing Program; does not apply	

Table 2 Cowlitz Salmon Hatchery - Fall Chinook Compliance With Performance Measures

		N/A	Yes	?	No		
#40	**For a new program, was the donor selection outline followed in selecting the hatchery broodstock?**						
#40a	Is a donor selection plan written?	4				Existing Program; does not apply	
#40b	Was the donor selection outline followed in selecting the broodstock?	4				Existing Program; does not apply	
#40c	Was the target stock recommended in the donor selection process actually used?	4				Existing Program; does not apply	

Table 2 Cowlitz Salmon Hatchery - Fall Chinook Compliance With Performance Measures

PM #	Description of Performance Measure	Compliance Status				Basis for Compliance or Non-Compliance	Remedial Action Needed for Compliance
		N/A	Yes	?	No		
#41	**For existing programs, were the broodstock collection procedures followed?**						
#41a	Is the broodstock collection plan written?		4			Review broodstock collection plan	
	Does the broodstock collection plan follow the guideline:						
#41b	Was an unbiased, representative sample collected?		4			Discussion	
#41c	Was the recommended number of broodstock collected?		4			Discussion	
#41d	Were the broodstock collection procedures in hatchery operation plan understood and followed?		4			Discussion	

Table 2 Cowlitz Salmon Hatchery - Fall Chinook Compliance With Performance Measures

PM #	Description of Performance Measure	Compliance Status				Basis for Compliance or Non-Compliance	Remedial Action Needed for Compliance
		N/A	Yes	?	No		
#42	**Was the appropriate number of spawners, male/female ratios, and fertilization protocols used?**						
#42a	Are the spawning protocols written?		4			Review of spawning protocols	
#42b	Are daily or weekly spawning logs available?		4			Review of records	
#42c	Was the appropriate number of spawners used?		4			Discussion	
#42d	Did you attempt to spawn all collected broodstock and randomize mating with respect to age class, and other traits?		4			Discussion	
#42e	Was the sex-ratio within the limits given in the performance standards?		4			Discussion	
#42f	Were the fertilization protocols followed?		4			Discussion	
#42g	If the hatchery needed to reduce the number of eggs retained, was this done by representative sampling of each male/female cross?		4			Discussion	

Table 2 Cowlitz Salmon Hatchery - Fall Chinook Compliance With Performance Measures

PM #	Description of Performance Measure	Compliance Status				Basis for Compliance or Non-Compliance	Remedial Action Needed for Compliance
		N/A	Yes	?	No		
#43	**Is there a genetics monitoring and evaluation program in place?**						
	Is a genetics monitoring and evaluation program available?				4	None provided	Develop approved genetics M&E plan
	Does the plan address the following elements listed in IHOT:						
	Does the program have elements needed to meet evaluation goals 1-4?				4	See above	See above
	Has a qualified geneticist reviewed and endorsed the program (goal 5)?				4	See above	See above
	Will the program collect the data and maintain the records needed to evaluate compliance on an ongoing basis (goal 5)?				4	See above	See above
	Is the program understood and followed by staff?				4	See above	See above

Section 4

Remedial Actions

Based on the compliance status for each performance measure, remedial actions were developed. The required remedial actions are organized into five categories. The types of categories range across a spectrum from those actions that are beyond human control, to those that require a change in agency policy or procedures, to those that involve a significant capital cost to put in place. The following are the five types of remedial actions identified under phase 1 of the audit:

The Five Types of Remedial Actions

Type	Description
1	Non-compliance issues resulting from items beyond human control or Performance Measures not relevant for this hatchery
2	Remedial actions requiring changes in agency policies or procedures
3	Remedial actions requiring changes in monitoring coverage or interval
4	Remedial actions requiring significant capital expenditures
5	Remedial actions that may require significant capital expenditures but are not clearly definable at this time

Remedial Actions at Cowlitz Salmon Hatchery -

Fall Chinook

This section presents the corrective actions required to bring the Cowlitz Salmon Hatchery - Fall Chinook program into compliance with IHOT performance measures. The remedial actions suggested here are just that, suggestions developed by the Montgomery Watson Audit Team. For some non-compliance areas, other remedial actions could be proposed. The required remedial actions are cross-referenced to each IHOT performance measure that was not in compliance. Where appropriate, the costs associated with the remedial actions are also presented (Table 3).

The cost estimates presented in this section are based on professional experience from similar projects. In most cases, only a lump-sum figure is presented, and detailed take-off lists have not been prepared. The cost estimates are essentially order of magnitude estimates (± 40%).

More importantly, the suggested remedial activities may also present several levels of action. Optional actions have been listed for several problems. These optional actions are desirable for either operational or safety considerations.

Table 3. Remedial Actions Required at Cowlitz Salmon Hatchery - Fall Chinook

Remedial Action Required	Cost	PMs[1]
Type 1 - Non-compliance issues resulting from items beyond human control or Performance Measures not relevant for this hatchery		
Increase adult returns	----	4b, 4h, 22a4
Type 2 - Remedial actions requiring changes in agency policies or procedures		
Document eyed-egg to fry survival	----	4e
Change pond cleaning procedures to improve production	----	4g
Document number of eggs, fry, fingerlings, smolts, and/or adults to meet basinwide needs	----	4i
Check water flow alarms daily	----	6
Conduct IHOT QA/QC tests for feed preparation	----	12
Change flow criteria for vertical stack incubators or increase flow	----	18
Develop smoltification goal and monitor	----	22a1
Follow IHOT protocols for disinfection of fish tank interior	----	23
Follow IHOT protocols for disinfection of transport vehicle cab	----	23
Follow IHOT protocols for wearing protective garments when handling fish eggs or cultural water	----	23
Verify that fish transport truck/chassis and tank/unit receive an inspection and service prior to the release season	----	23
Verify that a daily service inspection of the fish transport vehicle is completed before starting up and leaving for the day	----	23
Monitor DO in the transport tank	----	23
Follow IHOT temperature criteria for hauling	----	23
Develop training schedule	----	25
Develop approved genetics M&E plan	----	43

Remedial Action Required	Cost	PMs[2]
Type 3 - Remedial actions requiring changes in monitoring coverage or interval		
Monitor and record TGP	----	5b
Run analysis for water chemistry parameters, turbidity, alkalinity, hardness, nitrite, and contaminants	----	5c-5g
Type 4 - Remedial actions requiring significant capital expenditures		
Chill 780 gpm by 5 °F for incubation	$320,000	5a
Develop disease-free water supply for incubation and early rearing (1,300 gpm)	$750,000	5h, 28
Install alarms on adult holding, headboxes, and rearing ponds	$30,000	6
Install security alarms	$5,000	6
Install telephone pagers	$5,000	6
Construct new screening facility to meet IHOT criteria	$2.0 million	10
Construct bird netting over 125,000 sf of raceways	$250,000	11
Reroute discharge line to downstream of dam (72Ó line)	$300,000	13
Construct 4 additional BurrowÕs pond	$450,000	19
Increase flow by 700 gpm/unit for BurrowÕs ponds	$15,000	19
Type 5 - Remedial actions that may require significant capital expenditures but are not clearly definable at this time		
None	----	

Section 5

Hatchery Contribution to Fisheries, Spawning Grounds, and Hatcheries

This section presents the audit findings for the Cowlitz Salmon Hatchery - Fall Chinook program contribution of adult fish to fisheries, local fisheries, spawning grounds, and hatcheries. Data is reported by broodyear. A broodyear refers to the adult contribution from the eggs produced from a single group of spawning adults. For some species, this may include fish caught as 2-, 3-, 4-, 5-, and 6-year old fish. Because of the return distribution and data processing delays, the complete adult contribution for a given broodyear may not be available until 4 to 5 years after the fish have been released from the hatchery.

Table 4. Adult Contribution to Fisheries, Spawning Grounds, and Hatcheries: Cowlitz Salmon Hatchery - Fall Chinook

Year	Fisheries (Broodyear)	Spawning Grounds[1] (Broodyear)	Hatchery[1] (Broodyear)	Total Combined Contribution (Broodyear)	Smolt to Adult Survival (percent)
1981					
1982					

Data obtained from Missing Production Groups Annual Report or from the Regional Mark Information System database.

Total combined adult contribution; presented when it is not possible to subdivide the contribution into fisheries, spawning grounds, and hatchery contributions.

1983					
1984					
1985	417	26	109	552	0.28%
1986	147	50	120	317	0.15%
1987	41	11	45	97	0.05%
1988	109	39	74	222	0.11%
1989	114	14	37	165	0.09%
1990					
1991					
1992					

Annual Operating Expenditures

The level and detail of annual operating expenditures varies widely depending on hatchery, operating agency, and funding source. When provided, expenditures were presented in terms of personnel costs, operating costs (power, feed, supplies), capital costs, indirect costs charged to the federal government, third-party costs, and other costs. These cost components were summed to determine a total hatchery annual cost. Based on discussion with the hatchery manager, the percent of total hatchery costs allocated to a given program was estimated. The total hatchery costs and the percent of hatchery costs allocated to a given program were used to compute the cost of a given program. Table 5 shows the annual operating expenses for the Cowlitz Salmon Hatchery - Fall Chinook program. For programs that occur at more than one facility (as shown on Table 1 in Section 3 of this report), the cost breakdown for the component(s) at each facility is presented in separate tables (Table 5a).

Table 5. Annual Operating Expenses: Cowlitz Salmon Hatchery - Fall Chinook

Hatchery	**1994**	**1995**	**1996**
1. Cowlitz Salmon Hatchery	**$200,066**	**$221,329**	**$216,085**
2.			
3.			
4.			
5.			
Total Program Costs	**$200,066**	**$221,329**	**$216,085**

The total expenditures for the Cowlitz Salmon Hatchery are presented in Table 6 by program. The detailed breakdown of program expenditures at this hatchery are presented in separate tables (Tables 6a, 6b, 6c, and 6d).

Table 6. Annual Operating Expenses - Cowlitz Salmon Hatchery

Program	1994	1995	1996
1. Spring Chinook	**$789,550**	**$679,283**	**$714,337**
2. Fall Chinook	**$200,066**	**$221,329**	**$216,085**
3. Coho (Type N)	**$787,133**	**$785,737**	**$812,491**
4. Steelhead	**$7,140**	**$3,380**	**$0**
5.			
Total Hatchery Costs	**$1,784,882**	**$1,689,758**	**$1,743,543**

Table 5a. Annual Operating Expenses: Cowlitz Salmon Hatchery - Fall Chinook

Expenditure Occurring at Cowlitz Salmon Hatchery

Component	1994	1995	1996
Personnel Costs	$587,142	$322,910	$369,768
Operational Costs	$685,415	$782,595	$813,775
Capital Costs	$5,127	$58,763	$0
Indirect Costs			
Lumped Hatchery Costs			
Lumped Third-Party Costs	$507,198	$525,490	$560,000
Total Hatchery Costs	**$1,784,882**	**$1,689,758**	**$1,743,543**
Source of Funds			
Tacoma City Light	**100%**	**100%**	**100%**
Program Production (lb)	77,815	95,993	78,083
Total Production (lb)	694,224	732,869	630,035
Program as Percent of Total	11.2%	13.1%	12.4%
Program Costs	**$200,066**	**$221,329**	**$216,085**

When it was not possible to obtain a detailed cost breakdown from an agency or third party, the undivided costs were entered here.

Table 6a. Detailed Expenditures at Cowlitz Salmon Hatchery by Program

Spring Chinook

Component	1994	1995	1996
Personnel Costs	$587,142	$322,910	$369,768
Operational Costs	$685,415	$782,595	$813,775
Capital Costs	$5,127	$58,763	$0
Indirect Costs			
Lumped Hatchery Costs			
Lumped Third-Party Costs	$507,198	$525,490	$560,000
Total Hatchery Costs	**$1,784,882**	**$1,689,758**	**$1,743,543**
Source of Funds			
Tacoma City Light	**100%**	**100%**	**100%**
Program Production (lb)	307,093	294,720	258,128
Total Production (lb)	694,224	732,869	630,035
Program as Percent of Total	44.2%	40.2%	41.0%
Program Costs	**$789,550**	**$679,283**	**$714,337**

When it was not possible to obtain a detailed cost breakdown from an agency or third party, the undivided costs were entered here.

Table 6b. Detailed Expenditures at Cowlitz Salmon Hatchery by Program

Fall Chinook

Component	1994	1995	1996
Personnel Costs	$587,142	$322,910	$369,768
Operational Costs	$685,415	$782,595	$813,775
Capital Costs	$5,127	$58,763	$0
Indirect Costs			
Lumped Hatchery Costs			
Lumped Third-Party Costs	$507,198	$525,490	$560,000
Total Hatchery Costs	**$1,784,882**	**$1,689,758**	**$1,743,543**
Source of Funds			
Tacoma City Light	**100%**	**100%**	**100%**
Program Production (lb)	77,815	95,993	78,083
Total Production (lb)	694,224	732,869	630,035
Program as Percent of Total	11.2%	13.1%	12.4%
Program Costs	**$200,066**	**$221,329**	**$216,085**

When it was not possible to obtain a detailed cost breakdown from an agency or third party, the undivided costs were entered here.

Table 6c. Detailed Expenditures at Cowlitz Salmon Hatchery by Program

Coho (Type N)

Component	1994	1995	1996
Personnel Costs	$587,142	$322,910	$369,768
Operational Costs	$685,415	$782,595	$813,775
Capital Costs	$5,127	$58,763	$0
Indirect Costs			
Lumped Hatchery Costs			
Lumped Third-Party Costs	$507,198	$525,490	$560,000
Total Hatchery Costs	**$1,784,882**	**$1,689,758**	**$1,743,543**
Source of Funds			
Tacoma City Light	**100%**	**100%**	**100%**
Program Production (lb)	306,409	340,789	293,824
Total Production (lb)	694,224	732,869	630,035
Program as Percent of Total	44.1%	46.5%	46.6%
Program Costs	**$787,133**	**$785,737**	**$812,491**

When it was not possible to obtain a detailed cost breakdown from an agency or third party, the undivided costs were entered here.

Table 6d. Detailed Expenditures at Cowlitz Salmon Hatchery by Program

Steelhead

Component	1994	1995	1996
Personnel Costs	$587,142	$322,910	$369,768
Operational Costs	$685,415	$782,595	$813,775
Capital Costs	$5,127	$58,763	$0
Indirect Costs			
Lumped Hatchery Costs			
Lumped Third-Party Costs	$507,198	$525,490	$560,000
Total Hatchery Costs	**$1,784,882**	**$1,689,758**	**$1,743,543**
Source of Funds			
Tacoma City Light	**100%**	**100%**	**100%**
Program Production (lb)	2907	1367	0
Total Production (lb)	69,4224	732,869	630,035
Program as Percent of Total	0.4%	0.2%	0%
Program Costs	**$7,140**	**$3,380**	**$0**

PMs are performance measures that were extracted from the IHOT 1995 report. The IHOT

When it was not possible to obtain a detailed cost breakdown from an agency or third party, the undivided costs were entered here.

performance measures are listed in Table 2 (Section 3 of this report) in numerical order.

PMs are performance measures that were extracted from the IHOT 1995 report. The IHOT performance measures are listed in Table 2 (Section 3 of this report) in numerical order.